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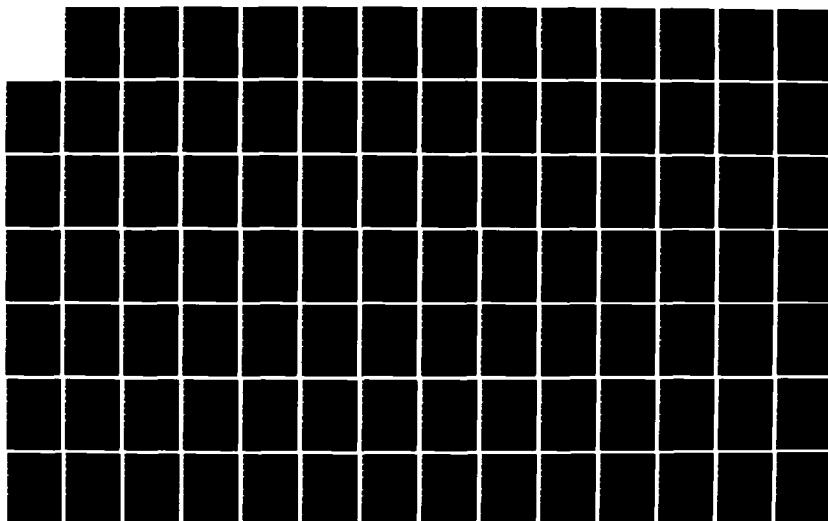
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Knowledge Worker Productivity Measurement: Establishing a
Foundation for the Development of Management Outputs for
Middle Level Managers of Budget-based Organizations

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A thesis submitted to North Carolina State University, Raleigh,
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ABSTRACT

ALMOND, ROBERT L., III. Knowledge Worker Productivity Measurement: Establishing a Foundation for the Development of Outputs for Middle Level Managers of Budget-Based Organizations. (Under the direction of Conniesue B. Oldham.)

The purpose of this research project was to determine the important management activities performed by Army lieutenant colonels. To accomplish this purpose, a questionnaire was administered to a sample of 93 active duty Army lieutenant colonels. The questionnaire consisted of two parts, one dealing with activities performed as part of the management process and the other concerned with background variables of the respondents. Data were analyzed using Statistical Analysis System (SAS) procedures. In addition to the determination of the relative order of importance of the management activities, factor analysis was used to group similar activities together in factor states. These factor states were then compared to the background variables; the result was that seventeen relationships were determined to be statistically significant. Results of this research may be used to develop output measures for middle level managers of budget-based organizations, leading to the development of a productivity measurement method for this particular subset of knowledge workers.

**KNOWLEDGE WORKER PRODUCTIVITY MEASUREMENT:
ESTABLISHING A FOUNDATION FOR THE DEVELOPMENT
OF MANAGEMENT OUTPUTS FOR MIDDLE LEVEL
MANAGERS OF BUDGET-BASED ORGANIZATIONS**

by

Robert L. Almond, III

**A research paper submitted in partial
fulfillment of the requirements for the
Degree of Master of Science**

**DEPARTMENT OF INDUSTRIAL ENGINEERING
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CHAPTER I

INTRODUCTION

A. Productivity in the Federal Government/ Department of Defense.

The government of the United States is one of the largest "businesses" in the world, with fiscal year 1984 expenditures exceeding 851 billion dollars. Outlays for the Department of Defense (DOD) accounted for 220.8 billion dollars of this total, or about 26 percent of all government expenditures [Office of Management and Budget, 1985].

Several hundred thousand government employees perform jobs very similar to their counterparts in private industry with one very important exception: The federal government does not operate with a profit motive. The lack of a profit motive restricts the ability of government managers to state goals or objectives in monetary terms other than establishing budgetary restrictions. The result is that government managers must often substitute intangible goals for the quantifiable goals used by their private industry counterparts which are based on profit.

Mundel delineates the difference in this way: "In upper-level control cycles in industry (top management controls), objectives are usually stated in net economic results desired. In the case of a non-economically motivated organization, such as government, objectives are stated in social or appropriate substantive results." [Mundel, 1975, p. 22]. The net result is that government managers have a more difficult time establishing quantifiable organizational objectives than their private industry counterparts.

Other studies have identified similar differences between government and the private sector. A study by H.G. Rainey comparing public and private organizations indicated government organizations tended to have greater multiplicity and diversity of objectives; greater vagueness and intangibility of objectives; greater tendency of conflicting goals; and greater rigidity and less innovativeness [Rainey, 1976].

Peter Drucker stated that private industry is paid only when its product fulfills a customer demand, whereas government organizations are "paid" out of a budget allocation. He also maintained that efficiency and cost control were not virtues in a budget-based organization, however much they may be emphasized [Drucker, 1954]. Given these differences, it is not surprising to find that

development of productivity measurement techniques within the government has generally lagged similar development in industry.

Despite the problems encountered by government organizations in measuring productivity, an attempt must be made at measurement since the readily available performance yardstick of industry, profit, does not apply to government organizations. The importance of productivity to the government sector was recognized over a decade ago. The following statement is no less applicable today than it was when first made 12 years ago.

"The financial resources available to government are being squeezed between multiplying public needs and the rising cost of meeting those needs, on the one hand, and a growing and understandable resistance on the part of the public to provide more tax resources on the other. One answer to this dilemma is improved productivity." [National Commission on Productivity, 1973, p. xiii].

This concern for improved productivity led to the issuance in 1975 of DOD Directive 5010.31, "Productivity Enhancement, Measurement and Evaluation - Policies and Responsibilities," which was updated in 1979. The primary objective of this program is "... to achieve optimum productivity growth (increase the amount of goods produced or services rendered in relation to the amount of resources expended) throughout the Department of Defense.

Productivity increases are vitally needed to help offset increased personnel costs, free funds for other priority requirements, and reduce the unit cost of necessary goods and services." [U.S. Department of Defense, 1975, p. 1].

Recent Congressional initiatives appear to focus on DOD as one major source for future budget cuts to reduce the federal deficit. These initiatives indicate that DOD will, in the future, have to make better use of fewer resources, enhancing the value of productivity improvement. DOD has over time increased the emphasis placed on productivity improvement [Mark, 1972; Gansher, 1977; Power, 1977]. The most recent effort to develop and test productivity measurement systems was undertaken by the Army Procurement Research Office in a study of methods used by defense contractors [Norton and Zabel, 1983].

Despite this continued emphasis by DOD, there is one significant area of productivity which has been virtually neglected, that of knowledge worker productivity. This neglect has not been confined to DOD, for private industry has only recently begun to focus on this area. The reasons for its neglect to this point and the scope of current thought will be more thoroughly examined in the Literature Review chapter.

B. Productivity Measurement.

Having established the importance of productivity to DOD, the next step is to determine how to accomplish its measurement. Productivity is often (and most simply) defined as the ratio of output to input. This definition is not complete, however, for consideration must be given to the goals of the organization. The output must be directed towards achievement of the goals of the organization, while the inputs are the resources consumed in producing the output. Also implied, but not stated, is the fact that productivity measurement has a time dimension (i.e., one ratio of output to input tells us little unless compared with a previous or future one). Based on these observations, a more accurate definition of productivity would be: the ratio of the quantity of output from an organizational system for some period of time divided by the quantity of input resources consumed by the organizational system for the same period of time, with the output directed towards the accomplishment of the organizational goals.

This definition indicates that productivity is related to both effectiveness and efficiency, and that these concepts must be considered in any measurement of productivity. For example, an organization may be effective in accomplishing its goals but may waste resources to do so. Likewise, an organization may be

efficient in its use of resources but fail to accomplish its goals. Any productivity measurement technique must, therefore, consider both effectiveness and efficiency if it is to have valid meaning.

The definition used above also emphasizes the key areas which must be defined before a valid productivity measurement technique may be developed. First, the organization must specify its goals. Both the output and the input of the organizational system must be measureable. Finally, a time period between measurements must be specified. Of these four areas, the most difficult one for government organizations to determine is the quantification of outputs. If output measures can be specified, then productivity measurements may be accurately made.

Definitions. There are many variations in the definitions used by different authors in this field. The definitions that follow are those used in this research and represent the author's interpretation of the significant ideas found in the literature.

- Goals --desired future conditions toward which efforts are directed.
- Resources --assets which are available to the organization (may include personnel, facilities, inventory, information, money, time, etc.).

- Input** --the quantity of resources consumed by the organization during a specified period of time.
- Output** --the quantity of goods produced or services provided during a specified period of time.
- Effectivness** --accomplishment of the goals of the organization considering timeliness, quantity, and quality.
- Efficiency** --the ratio of resources expected to be consumed divided by the resources actually consumed.
- Productivity** --the ratio of the quantity of output from an organizational system for some period of time divided by the quantity of input resources consumed by the organizational system for the same period of time, with the output directed towards the accomplishment of the goals of the organization.
- White Collar Worker** --a professional or technical worker who uses cognitive ability or skill-based activity to accomplish their job (such as in clerical, sales, professional, technical or managerial areas).

Knowledge Worker --a white collar worker whose job entails a significant amount of cognitive ability as opposed to skill-based activities.

C. Benefits of Productivity Measurement.

In a recent survey of DOD contractors, productivity was rated fifth in importance as a measure of organizational performance behind profitability, effectiveness, quality, and efficiency [Norton and Zabel, 1983]. If the value of productivity measurement to industry is relatively low, why should DOD expend resources in an attempt to define and measure it?

One reason is the lack of profit motive in government, as was previously noted, which eliminates profitability as a performance measure. A second reason is that productivity allows the comparison of a measure relating effectiveness and efficiency from one time period to previous measurements or to some standard in order to gauge the progress (or lack thereof) of the organization. This relative measure appears preferred to a strict absolute measure of either efficiency or effectiveness in assessing the achievement of intangible goals.

Productivity measures also have value for both current and future operations. For current operations, they may indicate a need for corrective action. Measurements may be used to compare similar operations to identify desirable

trends or methods. Future operations may be enhanced by improved resource allocation. Managers may also evaluate the effects of policy constraints on goal accomplishment in a more accurate and timely manner.

D. Research Objectives and Questions.

The objectives of this research are (1) to identify those activities Army middle managers think are most important in performing their jobs; (2) determine if any of these activities are related to each other and can be combined into factor states; and (3) determine if there is a relationship between background variables and perceptions of factor state importance. To accomplish these objectives, the following questions must be answered:

1. What activities are perceived as most important by Army middle managers?
2. Are any of these activities related in a way which causes them to be answered similarly by the respondents? If so, can the relationship be determined?
3. Are there background variables which are indicators of perceptions of factor state importance? If there appears to be a relationship, what is the cause?

Of the four parameters needed for productivity measurement, measuring output is the most difficult to accomplish. If output measures can be developed from the most important activities, however, productivity measurements can be made which will result in better management of both current and future operations.

CHAPTER II

LITERATURE REVIEW

Before proceeding to the research methodology used in this project, it is necessary to review the pertinent literature dealing with knowledge worker productivity measurement in both DOD and industry. After delineation of the goals and guidelines of the DOD productivity program, several previous studies conducted by DOD agencies, industry researchers, and academicians will be reviewed.

Due to the diversity in the types of knowledge workers and their job requirements, this study will narrow its scope to focus on one particular subset of knowledge workers, middle level managers in the United States Army. The similarities between civilian and military managers are then discussed, followed by identification of several management activities and background variables found in the literature.

The objective of this research is to determine the most important management activities as perceived by the managers themselves. Determination of the important activities will facilitate identification of key output measures, the most difficult parameter to develop in assessing productivity of knowledge workers.

A. DOD Productivity Program.

The DOD productivity program was established in 1975 with the issuance of DOD Directive 5010.31, "Productivity Enhancement, Measurement and Evaluation - Policies and Responsibilities," and DOD Instruction 5010.34, "Productivity Enhancement, Measurement and Evaluation - Operating Guidelines and Reporting Instructions." These two documents provide the foundation for the productivity program of all DOD agencies.

DOD Instruction 5010.34 sets forth the following goals for the head of each DOD component.

- "1. Establish annual productivity goals (preferably by type of support function) for his Department/Agency.
2. Appropriately subdivide annual productivity improvement goals by major command and operating agency prior to the beginning of each fiscal year.
3. Advise the Secretary of Defense, by October 31 each year, of the Department/Agency productivity improvement goals and the subdivisions thereof." [U.S. Department of Defense, 1975, p.2].

The instruction also requires that each Department/Agency implement a productivity program. Guidelines for this program include: priority emphasis on productivity enhancement at all organizational levels; maximum use of existing resource management systems; development and use of productivity measurements which are accurate and focus on

the primary mission; accumulation of productivity data (both input and output); use of productivity data to develop manpower and funding requests; provide qualified personnel to sustain the productivity program; and periodically review the program to assess its effectiveness [U.S. Department of Defense, 1975].

A section in the DOD Instruction provides sample output indicators which may be used to develop a productivity index. Review of this list of indicators reveals few which are applicable to knowledge workers, evidence of a lack of emphasis in this area. Given the nature of government organizations and the provisions of the DOD Productivity Program, further research must be conducted to attempt to define the output of the knowledge worker segment of DOD.

B. Knowledge Worker Productivity Literature.

A review of productivity studies performed within DOD reveals that the majority have been made by students at the Air Force Institute of Technology (AFIT), although the earliest study found was a contract study performed for the Navy. This study concluded that the accuracy and meaningfulness of a productivity measurement model depends on the accuracy of input and output measures, development of standards, and aggregation of results to higher levels. Another finding was that some organizations have outputs which preclude formation of a productivity measure in the

traditional sense (output/input). The three types of output which preclude development of a feasible productivity measurement model were: output which is intangible and cannot be measured; output which varies inversely with activity; and output from organizations which only function under emergency conditions. The study concluded that even though a productivity measurement model would not truly measure productivity in these cases, it would still be useful to a manager in assessing whether the organization was understaffed or overstaffed [Mellonics Systems Development Division, 1969].

One of the early studies at the Air Force Institute of Technology measured the productivity of a Base Civil Engineer section as the ratio of manhours estimated to actual labor manhours expended. Although there may be problems with inaccurate estimates, production inefficiencies, or error in data collection, this method was one of the first which focused on the measurement of intangible output [Hanley and Smith, 1976]. A later thesis developed a productivity measurement model based on a ratio of performance indicators to inputs in an attempt to link actual output and organizational objectives [Baumgartel and Johnson, 1979].

Kaneda and Wallett used a questionnaire to derive productivity measures for the Base Civil Engineer Section, but this method only accounted for approximately 40 percent

of the time expended by engineers in the design section [Kaneda and Wallett, 1980]. This thesis and that of Baumgartel and Johnson did not address individual measures, although both recommended future research to develop output and productivity measures for individual engineers.

Several authors outside DOD have also concentrated their efforts on organizational measurement rather than individual measurement [DeWitt, 1970; Grahn, 1981; Rowe, 1981]. This appears to be largely a matter of convenience, since aggregate outputs of departments/organizations are probably more easily defined than outputs of individuals. Some of these authors also included a recommendation for development of individual measures.

Other problems exist in defining knowledge worker productivity measures. Aside from the difficulty in specifying the "output," there is frequently a tendency to measure activities rather than output [Ruch, 1980; Shipper, 1983]. There may also be a significant time lapse between the activity and its resulting output [Grahn, 1981; Ruch, 1980; Trozzo, 1971].

One final dimension of importance is that of the quality of the output, since it is probably more difficult to determine than the quantity [Ruch, 1980]. Despite these problems, however, most of these authors acknowledge the necessity of measuring the productivity of individual knowledge workers.

Both industry and the academic community have also undertaken research projects attempting to develop knowledge worker productivity measures. A four month study on state-of-the-art productivity measurement theories and techniques identifies three techniques useful with knowledge workers: Normative Productivity Measurement Methodology; Management of Productivity by Objectives; and IBM's Common Staffing Study [Sink, 1984].

The American Productivity Center is currently conducting an experiment on white collar productivity improvement which will ultimately involve ten companies and 60 different departments. This project and the Sink study constitute the most recent attempts at defining knowledge worker productivity and seem to indicate increased emphasis on research in this area.

C. Middle Level Managers: Basis of the Study.

Knowledge workers are not a homogeneous group, although they tend to be treated as such in most of the literature. Knowledge workers may be divided into five categories: Management, Supervision, Support Units, Marketing, and Service Producers. These categories provide an initial division so that different formats are possible for measuring knowledge workers [Ruch, 1980].

The area selected by this author for research is that of middle level management. Management as a category is one of the least well defined, while there are a large number of

management personnel in DOD. Middle level managers have been depicted as "the funnel through which the intentions of top management flow down and information flows up. The middle managers are also the integrators; they operate the management systems that make the organizations work. It is certainly no exaggeration, then, to say that the effectiveness of the nation's more than four million managers is of crucial importance. If an organization can provide an environment in which its middle managers can increase their development and productivity, the effectiveness of the entire organization multiplies." [Kay, 1973].

This author chose to represent middle level managers by using lieutenant colonels in the United States Army. The jobs performed by lieutenant colonels conform with the definition of middle management used by McFarland [McFarland, 1970]. Several studies have been conducted which have shown the similarity between industry and the military [Thomson, 1964; Van Fleet, 1984; Yarmolinsky, 1971]. While recognizing that there are limits to the civilianization of military management, the relationship is best summed up by the following: "We can apply this definition (of organization) equally well to a business organization or to a military establishment. While the two differ in their objectives, in the incentives essential to their effective functioning, and in the specific details of organization and operation, the basic functions of managing

remain the same. The same basic managerial skills are required, and both have the same need to develop the knowledge and skills essential to effective managing." [Houston, 1964, p. 81].

D. Management Activities and Background Variables.

One reason for the lack of progress in developing knowledge worker productivity measures is the difficulty in defining the output of the individual. With the outputs generally undefined, the next step is to determine those activities of middle managers which lead to desirable outputs.

Various activities were grouped into the four managerial functions identified by a majority of recent management thinkers (refer to Appendix A) [Miner, 1973]. These functions - plan, organize, direct, and control - provided the categories for classification of various activities found in the literature. A list of these activities is found in Appendix B [Headquarters, Department of the Army, 1975; Hayes, 1964; Houston, 1964; Staake, 1964; Halligan, 1977; Allen and Lintean, 1980; Tuttle, 1983; Brostrom, 1976].

An additional aspect of this study is the selection of several background variables (some unique to the military) to compare with responses on activity importance. The variables considered are shown in Appendix C [Headquarters,

Department of the Army, 1975; Blake, 1964; Papanek, 1964; Staake, 1964; Mascarella and Browne, 1970; MacDonald, 1978; Allen and Linteau, 1980; Coggeshall and Jasso, 1975].

CHAPTER III

RESEARCH METHODOLOGY

A study was designed as part of this research project to gather data on Army middle level managers' perceptions of the importance of various management activities. Development of this study involved selection of the sample from the survey population, design of the survey instrument, and selection of the data preparation and analysis techniques to be used.

A. Sample Selection from the Survey Population.

Before designing the survey instrument, it was necessary to select the survey population to provide the data for analysis. The population for this research included all Army lieutenant colonels. The sample was selected from Army lieutenant colonels assigned to three separate departments at two different geographical locations (the Combined Arms and Services Staff School (CAS³) and the Combined Arms Combat Developments Activity (CACDA) at Ft. Leavenworth, Kansas; and the Military Personnel Center (MILPERCEN) in Alexandria, Virginia). These locations were selected because of the large number of lieutenant colonels assigned there, thus easing distribution problems.

This method of selecting the sample resulted in a stratified purposive sampling method [Tull and Hawkins, 1984]. The sample was selected with a specific objective in mind (higher number of above average performers) but was stratified because only lieutenant colonels were selected. The disadvantage of the purposive sample (non-representative of the population as a whole) seemed minor at worst and more than offset by the advantages of stratification (reduces sampling error and sample size).

One hundred and three officers were selected as the sample, representing 1.2 percent of the total number of Army lieutenant colonels. Of these, 39 were assigned to MILPERCEN, 35 to CAS³, and 28 to CACDA. The last sample member was the Professor of Military Science at N.C. State University.

Army lieutenant colonels were chosen to represent middle level managers for a number of reasons. As previously noted, there is a great deal of similarity between military and civilian managers. Army lieutenant colonels generally have 16 to 22 years of service, providing a consistent number of years' experience within the organization and across the sample. Additionally, those officers assigned to the locations chosen usually have had more than one assignment as a lieutenant colonel, and a large number will have been selected for battalion command (top 6 percent of an officer year group).

The members of the sample, although possessing a large number of different job specialties, had several other similar characteristics. Most of the officers have attended similar service schools as well as other courses where management related classes are a part of the curriculum. A large percentage have advanced degrees from civilian universities. They are all part of the same organization, and as such have in common the goals specified for the organization. These common characteristics create a more homogeneous sample than that which could be obtained from industry, resulting in data with less within group variation due to differing perspectives of respondents.

B. The Survey Instrument.

After defining the sample, the survey instrument to collect the data had to be selected. A survey was selected since the other options of experiment and/or use of aggregate data did not appear feasible. Although there are many variations, the three most common types of surveys are: (1) face-to-face interviews; (2) telephone interviews; and (3) mail-out questionnaires. Because of the size and dispersion of the sample, the mail out questionnaire was selected as the most reasonable survey instrument.

The mail out questionnaire has numerous advantages which recommend its use. Advantages to the researcher include efficiency of distribution with a high probability of reaching the respondent, less requirement for assistance,

less expense, and processing and analysis of data are generally easier than with other methods. The respondent can remain anonymous or may consult with others (both may be disadvantages). The advantages to the research study are the lack of bias in responses based on interviewer style and the possibility of using a larger sample [Bradburn and Sudman, 1982; Burges, 1976; Jonsson, 1957; Oppenheim, 1966; Weisberg and Bowen, 1977].

Disadvantages of using a mail out questionnaire also existed. Questions must be simplified to avoid ambiguity, precluding the use of more than a few open ended questions. There is no control over the sequence questions are read and/or answered. There is typically a low response rate, and it frequently takes two months or longer for all questionnaires to be returned. Finally, non-response to questions will be higher, which introduces bias because non-response is not a random process [Burges, 1976; Oppenheim, 1966]. Despite these disadvantages, the advantages appeared to make the mail out questionnaire the superior choice.

The questionnaire was divided into two parts, individual information and management activities. A copy of the questionnaire is contained in Appendix D.

Individual information was concerned with gathering descriptive data about individual respondents (Questions 1-15). These questions were derived from the background variables in Appendix C. This information was used to

classify respondents to determine if perceptions of activity importance varied according to classification.

Management activities were selected from the list found in Appendix B. The comments in parentheses following activities were added to insure clarity and uniformity of understanding among respondents. Six activities from each of the four management functions (Plan, Organize, Direct, and Control) were selected, and then their order was randomized to prevent respondent bias towards any individual management function. The tendency of the sample to provide descriptive responses (defining what is done, not what should be done) was offset by the prescriptive selection of the management activities.

Question content and wording were considered critically important in obtaining the quality of data required. Brevity, simplicity, and ease of response were factors considered to improve the probability that sample members would respond. Questions were formatted to make the questionnaire mechanically easier to answer. Although much attention was given to developing a questionnaire requiring as little of the respondent's time as necessary, the quality of the data was always of paramount importance.

One requirement for the measurement scale used to rate the management activities was that it reflect the attitude of the respondents as accurately as possible. Responses dealing with attitudes normally require nominal or ordinal

scaling [Fairweather, 1967; Fairweather and Tornatzky, 1977]. The measurement scale used was a seven point Likert scale slightly modified so that only the endpoints were defined (1 = very important and 7 = not important). This allowed the use of an ordinal measure but provided the means to apply a numerical score to reflect the respondent's attitude of the importance of a particular activity.

Use of an ordinal scale is seen as a disadvantage by many researchers in that intervals between any two points are not known for certain. The difficulty in assigning absolute measures when dealing with attitudes has been previously recognized, however, and research of this problem has shown that:

1. "The distinction between ordinal and interval scales is not sharp. Many summated scales (such as the Likert scale) yield scores that, although not strictly of interval strength, are only mildly distorted versions of an interval scale.
2. Some of the arguments underlying the assertion that parametric procedures require interval strength statistics appear to be of doubtful validity.
3. Parametric procedures are, in any case, robust and yield valid conclusions, even when mildly distorted data are fed into them. Furthermore, if the distortions are severe, various transformation techniques can be applied to the data." [Gardner, 1975, p. 55].

Other research has shown that the Likert scale method of attitude measurement yields results which generally make it the preferred method for attitude measurement. Some of the reasons for this are: it is faster and avoids the difficulties encountered when using a judging group to construct the scale (such as the Thurstone Differential Scale); it yields reliabilities as high as other techniques using fewer items; and it is possible to obtain the most typical measure of the attitude of the individual and also provides the range of dispersion of the individual's attitude [Summers, 1970].

There were several assumptions inherent in this particular survey instrument. It was assumed that responses were both honest and reliable. Another assumption was that experience levels of the respondents were adequate to provide sufficient background to accurately judge the importance of the activities. A third assumption was that the use of a Likert scale would result in only mild distortions of interval level data which would then allow the use of parametric statistical techniques. A final assumption was that the results of this survey can be generalized to other subsets of middle level managers.

The final requirement in the development of the questionnaire was to assure the validity of its contents. Since there were no studies of this nature with which to compare the content, a three-step effort was initiated to assess validity prior to distribution.

The first step was a review of the background variables and management activities selected for inclusion in the questionnaire. This review was made by two industrial engineering professors with backgrounds in management systems and a professor of economics and business with a background in marketing research (the researcher's advisory committee). While it is recognized that it may have been preferable to have members of the survey population provide the items to be included, time constraints prevented using this technique. It should be noted that items included were frequently mentioned in the literature as being among the most significant and that none of the respondents cited activities which they felt were important but missing from the questionnaire.

The second step was a review of the questionnaire by a member of the Statistical Consulting Service. This service is provided by the Department of Statistics of the university to assist graduate students and faculty members in design and development of research methods and to assist in analysis of results. This review resulted in recommendations for some minor changes designed to facilitate the coding and analysis of responses.

The final step to assure validity was a pretest of the questionnaire using the field grade officers assigned to the Military Science Department of the university. The pretest revealed no significant problems although several questions

were modified to improve clarity and reduce the chance of misinterpretation. After the pretest and revisions were completed, the revised questionnaire was reviewed again by both the advisory committee and the member of the consulting service.

Distribution of the questionnaire was accomplished by using points of contact (POC) at each location. The POC at MILPERCEN provided the names and addresses of sample members, and a packet (consisting of a cover letter, questionnaire, and stamped self-addressed return envelope) was mailed directly to each individual. Distribution at Fort Leavenworth was accomplished by the POC using the post distribution system after obtaining approval for distribution from the two department heads concerned. Although the questionnaires were not mailed directly to the Fort Leavenworth sample, no difference in the response rate was observed. Response to the questionnaire was voluntary at both locations, and anonymity of the respondents was guaranteed.

The initial mailing was made on 1 April, 1985. Prior to the follow-up mailing on 29 April, 1985, a total of 83 responses (out of 103) were received. The follow-up mailing resulted in receipt of 12 more responses, bringing the total response rate to 92 percent. This exceptional response rate may have been attributable to several factors, but most likely resulted from individual interest in the subject

area. Evidence of this interest was the request of 18 of the respondents to be furnished with a copy of the results of the survey, the only incentive offered to the sample for responding.

C. Data Preparation and Analysis Techniques.

The analysis plan was designed to break down and order the data into meaningful groups and search for patterns of relationships among these groups [Emory, 1980]. The first step in this process was to edit raw data. The editing process is designed to insure accuracy, consistency, completeness, and the acceptability of the data for tabulation, coding, and analysis [Blank, 1984; Emory, 1980].

During the editing process, several different types of errors were found. Questions which were not answered were discarded, as were those questions with more than one answer. In cases where the respondent had obviously changed an answer (one of two responses was "blackened out"), the second answer was accepted.

After receipt of all responses, two adjustments were made to the data file prior to final analysis. Responses to the questionnaire by two sample members were completely removed from the data file. In both cases, the respondents had indicated a rating of 7 (not important) for twelve of the twenty-four management activities. No other respondent indicated more than four "not important" ratings. This

fact, coupled with the literature review, indicated a lack of consistency between these two respondents and the remainder, so the analysis was made with a sample with $n = 93$. The other adjustment was made by placing an individual with a Master of Education degree in the MA/MS category of the college degree level question.

The second step in the analysis plan was the coding of the data. This consisted of assigning numerals to the responses to enable them to be assigned to a limited number of classes [Blank, 1984; Emory, 1980]. This process was simplified by the format used for the questionnaire. The Survey Code Structure and Format are found in Part I of Appendix E. Part II shows the encoded information for the 93 responses analyzed.

The final part of the analysis plan was the selection of the analytical techniques to be used. The techniques selected were based on the advice of the consultant provided by the Statistical Consulting Service.

The first technique used was exploratory factor analysis in an attempt to determine if an underlying pattern of relationships existed. This technique is widely used with Likert items and attempts to reduce a large number of variables into a smaller number of groups based on the respondent's item scores. This data reduction capability is important in maintaining a large number of degrees of freedom when the sample size is small relative to the number

of variables considered [Kim, 1975; Kim and Mueller, 1978; Korth, 1975; Moser and Kalton, 1972; Rummel, 1970].

The three customary steps of factor analysis - preparation of the correlation matrix, extraction of initial factors, and rotation to a terminal solution - were accomplished using the SAS computer program procedure FACTOR ROTATE = VARIMAX. The correlation matrix was produced by calculating the correlations between all possible pairs of items. A principal components analysis was then used to extract the initial factors, and the linear relationships were used to transform the given set of management activities into a new set of principal components orthogonal (uncorrelated) to each other. VARIMAX was the orthogonal rotation method applied to the initial factors to produce the transformed set of factors. The rotated factors are found in Appendix F.

The final step of the factor analysis was to use the scores of the transformed set of factors and combine those that were related. This was done by grouping those with high ($>.5$) factor loadings together. The scores for all items in each group were summed to produce a single score for each combination. This procedure must be used with caution, however, because "only under very limited conditions can one unequivocally determine the correlations among the observed variables." [Kim and Muller, 1978, p. 8].

Several criticisms of the factor analysis technique exist, although experiments have shown that a principal component analysis has performed best at retention of prediction across samples [Korth, 1975]. One criticism is that use of factor analysis requires the assumption of a near multinormal distribution if tests of statistical significance will be applied to the factor results. A second criticism is that an assumption is made of the additivity and linearity of the data. A final criticism is that factor analysis produces arbitrary (nonreproducible) results.

Although there is some validity in each of these criticisms, many very complex functions can be reduced to linear vector space, and the solution to the principal component analysis of a data matrix is mathematically unique [Rummel, 1970]. Given the size of the sample and no indications to the contrary, the assumption of a near multinormal distribution was made to allow use of parametric procedures.

The combined factor states which resulted were next compared to the background variables using analysis of variance to test for levels of significance. A fixed effects model was assumed, and the "classic experimental approach" was used since the design had unequal cell frequencies. This approach can be used when the factors do not have a known causal order but the main effects are

assumed to be more important than the interaction effects [Kim, 1975]. The 5 percent significance level ($Pr > F = .05$ or less) was used, although all relationships significant at the 10 percent level or better were examined.

Once the relationship was determined significant, Duncan's multiple range test was applied to determine which categories within the classification were significantly different. This method uses different range values for different size subsets in order for the difference in means, which are assumed equal, to be declared significant. Since the cell sizes were unequal, the Duncan procedure yields only approximate results [Kim, 1975]. This procedure was used rather than one which produced exact results because it was able to differentiate categories for all relationships found significant at the .05 level.

CHAPTER IV

ANALYSIS OF RESULTS

The application of the research methodology described in the previous chapter resulted in several findings of statistical significance. Before examining the mean scores of the individual management activities, the demographic characteristics of the respondents will be discussed. The factor states resulting from the factor analysis are then presented together with working hypotheses attempting to explain the similarities which caused them to be grouped jointly. Those factor states found to be significant after comparison with the background variables were next tested to determine which categories of respondents tended to answer in similar ways. The final part of the analysis presents hypotheses for the trends found to exist between the factor states and the different categories within the background variables.

A. Sample Characteristics.

The respondents had a high level of formal education, all possessing bachelor's degrees and over 82 percent with advanced degrees (MA, MS, PhD, MBA). In addition, 49 percent had been either the distinguished graduate (top graduate of the class) or an honor graduate (top 10 percent) of one or more service schools.

Slightly more than half of the respondents indicated Combat Arms as their job specialty area, with 27 percent indicating Combat Support and 19 percent Combat Service Support specialty areas. Most of the jobs found in the Combat Support and Combat Service Support areas are similar to jobs found outside the military, while Combat Arms jobs (except for aviation) are unique to the military environment. Just under 80 percent of the respondents indicated ten or more years experience in their specialty, with only 2 percent indicating less than five years of experience.

The sample contained a high number of what are considered to be the most successful officers in the Army. Although only 3 percent of the sample were selected early for promotion to lieutenant colonel ("below the zone"), over 59 percent had been selected for battalion command. This percentage was disproportionately high in the sample since only the top 6 percent of an officer year group are selected for battalion command. This was not seen as a disadvantage in this study, however, and in fact resulted in several findings of significance.

The large number of selectees for battalion command produced a skewed response to the question concerning the largest number of people supervised (had responsibility for) in any one job as a lieutenant colonel (45 percent of the sample responded more than 600). The span of control of the

respondents was fairly evenly distributed despite the fact that those assigned to CAS³ generally had ten or more students (considered to report directly to them in this case). Only 15 percent of the sample were currently responsible for more than 25 people, indicating the not unexpected result that most of the respondents were currently involved in staff-type jobs.

The rapid job turnover rate for Army officers manifested itself in the respondents' answer to several questions. Although the average length of time as a lieutenant colonel was just shy of 44 months, the average respondent had held three different jobs during this time. The high job turnover rate was also suggested by the fact that almost 70 percent of the sample had been in their present job 12 months or less. The advantage of job continuity which probably exists in private industry, however, may be partially or wholly offset by the increased management experience gained by having several different jobs.

One of the more popular myths concerning the management style of Army officers is that it is strict, inflexible, and less concerned with subordinates than with organizational results. While accomplishing the mission is of paramount importance, 78 percent of the respondents characterized their predominant management style as either coordinative (40 percent) or participative (38 percent).

The response to three questions in the survey concerning background variables was nearly unanimous. All of the sample members were male and all but two were classified "White, not of Hispanic origin." There were only two respondents who had not served in a hostile fire zone. Although the questions concerning race and gender were for demographic purposes only, the response to the question concerning combat experience precluded any meaningful analysis using this variable.

B. Sample Means for the Management Activities.

The first step in analyzing the responses was to calculate the mean for each of the management activities. The literature review indicated that each of these activities was important, and calculation of the response means provided a method to test the relative importance of one activity with another.

The findings of the survey supported both of these contentions. None of the means were below the midpoint of the Likert scale, indicating that all activities were considered to be on the "very important" half of the scale. Several respondents included written comments that all activities were important but that they were rating them relative to each other. This appeared true for the sample as a whole since over 80 percent rated one or more activities "4" or higher (higher numbers representing less

importance). The means for each activity are shown in Table 1. It should be noted that these results were obtained during a peacetime rather than a wartime atmosphere, where the results would probably be different.

There are three trends which are apparent from the findings presented in Table 1. The most pronounced of these is that planning is rated as the most important overall of

Table 1: Sample Means for the Management Activities
(in descending order of perceived importance).

Activity Code	Activity	Mean (1 = very important)
D17	Motivate subordinates to achieve organizational goals	1.57
P29	Establish goals, objectives, and priorities for the organization	1.65
019	Delegate authority to subordinates	1.67
032	Develop subordinates for promotion to next level	1.77
P18	Forecast potential problems	1.81
P21	Respond to new requirements and/or unforeseen circumstances	1.95
036	Set performance standards	2.02
C22	Conduct performance appraisals	2.02
C28	Achieve performance standards	2.02
P16	Develop and integrate plans	2.14
P34	Forecast future resource needs	2.18
D35	Improve the quality of the workforce	2.23
D38	Manage the flow of information and communications	2.29
C30	Report to higher echelons	2.29
037	Establish milestone schedules	2.39
P20	Create innovative ideas	2.48
023	Administer policy	2.56
C24	Compare actual versus projected results	2.94
D33	Minimize "not operationally ready" equipment	2.95
C27	Conduct periodic inspections of operations	2.97
C39	Collect and analyze data	3.03
D26	Implement planned change and meet modification schedules	3.04
D25	Minimize age of backorders/late documents	3.28
031	Attend/complete courses to improve technical, human or conceptual skills	3.71

the four management functions. Five of the six planning activities were rated in the top half of the 24 activities, and three of the six most highly rated activities were planning activities.

The second trend is that directing appears to be the least important of the management functions. Four of the six directing activities are rated in the bottom half of the 24 activities. Two directing activities are among the four lowest rated activities with means above "3."

The third trend is that the management function of controlling emerges as less important (4 activities in the bottom half) than either planning or organizing, but slightly more important than directing. Three of the seven lowest rated activities are controlling activities, and these lowest seven have a relatively large difference in means from the remainder.

There are two specific findings based on the means which are worthy of note. The most significant finding is the great amount of emphasis the respondents place on relationships with subordinates. Of the four most important activities, three are concerned with the interaction between the manager and his subordinates. This indicates that respondents perceive their most important management responsibility to be the education and training of their subordinates.

The second finding occurs at the opposite end of the scale. Despite the high education level of the sample, the

least important activity (by a wide margin) identified was attending/completing courses to improve technical, human, or conceptual skills. It is possible this occurred because the respondents had attended numerous schools previously and felt that further education was of marginal benefit as compared to other uses of their time.

C. Factor Analysis Results.

The next step in the analysis was the combining of two or more of the activities within a management function to produce a factor state. The factor states, factor state names, and their component activities are listed in Table 2 (on the following page). As described in the research methodology, the factor states were generated by using the mathematical technique of factor analysis. The fact that the relationship between/among activities is mathematical precludes determination of the exact nature of the relationship although some similarities are evident.

The link among the activities in factor state PLFS1 (Plan-Early) appears to be the time of their occurrence. Both "develop and integrate plans" and "establish goals, objectives, and priorities for the organization" are activities which are normally completed in the early stages of setting the organization in motion. To the extent that "forecast potential problems" may be seen as contingency planning, it would also fit this pattern.

Table 2: Factor Groupings of Management Activities.

Factor State	Factor State Name	Planning Activities
PLFS1	Plan-Early	Develop and integrate plans Forecast potential problems Establish goals, objectives, and priorities for the organization
PLFS2	Plan-Future	Create innovative ideas Respond to new requirements and/or unforeseen circumstances Forecast future resource needs
<u>Organizing Activities</u>		
ORGFS1	Organize-Administration	Administer policy Attend/complete courses to improve technical, human, or conceptual skills Set performance standards Establish milestone schedules
ORGFS2	Organize-Subordinates	Delegate authority to subordinates Develop subordinates for promotion to the next level
<u>Directing Activities</u>		
DIRFS1	Direct-Time	Minimize age of backorders/late documents Implement planned change and meet modification schedules Manage the flow of information and communications
DIRFS2	Direct-Subordinates	Motivate subordinates to achieve organizational goals Minimize "not operationally ready" equipment Improve the quality of the workforce
<u>Controlling Activities</u>		
CONFS1	Control-Operations	Conduct performance appraisals Compare actual versus projected results Conduct periodic inspections of operations Achieve performance standards
CONFS2	Control-Reporting	Report to higher echelons Collect and analyze data

The characteristics in factor state PLFS2 (Plan-Future) which seem to relate the activities concern both cognitive ability as well as a possible connection in their timing. These three activities require imagination and the ability to predict or create solutions to unknown events. The time dimension characteristic which these activities share is that they may generally be thought of as responding to future events rather than present or past incidents.

Factor state ORGFS1 (Organize-Administration) contains activities which are concerned with the establishment of the rules and administrative procedures of the organization. The activity pertaining to education (attend/complete courses) may be related to the others in that it is perceived as a prerequisite to the establishment of the framework of the organization.

The two activities in factor state ORGFS2 (Organize-Subordinates) share the common characteristic of dealing with subordinates. Their factor loadings indicate a very strong relationship which may explain why both were perceived so similarly in importance by the respondents.

The activities in factor state DIRFS1 (Direct-Time) appear to be associated with effective time management. Each activity deals with a different period on the time continuum. Minimizing the age of backorders/late documents concerns past events, managing the flow of information and

communications applies predominantly to the present, while implementing planned change affects the future.

Two of the activities in factor state DIRFS2 (Direct-Subordinates) are related to subordinates. The relationship of minimizing "not operationally ready" equipment is less clear. It is possible that it was perceived as a subset of motivating subordinates to achieve organizational goals rather than as a separate and distinct activity.

The four activities in factor state CONFS1 (Control-Operations) may be thought of as the management of continuing operations. Each of these activities is important to the day-to-day operation of the organization, and the high factor loadings for each suggest a strong relationship.

The last two activities, comprising factor state CONFS2 (Control-Reporting), seem to be concerned with the reporting aspect of controlling. The relationship appears to be pronounced based on the factor loadings. This suggests that collection and analysis of data is more important in fulfilling requirements of higher level managers and of less importance in day-to-day operations.

D. Related Factor States and Background Variables.

Using the assumption that the factor states and background variables were independent, the F statistic was calculated for each combination using the analysis of variance (ANOVA) procedure. The probability associated with each F value is shown in Appendix G.

Since the time-in-grade for each respondent was given in months, a check for correlation between this variable and the eight factor states was made. This check revealed no significant correlation between the factor states and the time-in-grade.

Of the 104 remaining combinations, the ANOVA procedure revealed seventeen significant at the .05 level and five significant at the .10 level. These are listed in Table 3 on the following page. Although Duncan's multiple range test was applied to all of these combinations, only those significant at the .05 level will be discussed. The results of the Duncan tests for these combinations (the Scheffe test was used for pairwise comparisons) are found in Appendix H.

As previously noted, the means used for the factor states were the sum of the means of the individual activities within that factor state. Since the Likert scale used a rating of 1 for "very important," higher means implied less importance, while lower mean scores indicated a relatively higher degree of importance.

The first factor state/background variable relationship of significance was between Plan-Early and the largest number of people for which the respondent had supervisory responsibility. Results indicated that those respondents having had responsibility for 50 people or less were significantly different from those having had responsibility for 201 to 400 people. Those responsible for fewer people perceived this factor state as less important. The general

trend was that the more people the respondent had supervised in any one job, the more important the activities of this factor state became. This most likely occurred due to the increased complexity of larger organizations and the need for more detailed planning to assist in goal accomplishment.

Table 3: Factor State and Background Variable
Significant Relationships.

Significant at the .05 Level

Factor State*	Background Variable	Pr > F
PLFS1	Largest number of people responsible for as a lieutenant colonel (LTC)	.0469
PLFS2	College degree level	.0133
ORGFS1	Months in present position	.0455
ORGFS1	Largest number of people responsible for as LTC	.0224
ORGFS2	Number of jobs performed as LTC	.0238
ORGFS2	Months in present position	.0173
ORGFS2	Largest number of people responsible for as LTC	.0001
ORGFS2	Primary selectee for battalion command	.0001
DIRFS1	Job specialty (Combat Arms, Combat Support, Combat Service Support)	.0395
DIRFS2	Job specialty	.0395
DIRFS2	Number of jobs performed as LTC	.0221
DIRFS2	Largest number of people responsible for as LTC	.0001
DIRFS2	Primary Selectee for battalion command	.0027
CONFS1	College degree level	.0380
CONFS1	Months in present position	.0120
CONFS1	Largest number of people responsible for as LTC	.0001
CONFS1	Primary selectee for battalion command	.0129

Significant at the .10 Level

PLFS1	Number of jobs performed as LTC	.0981
PLFS1	Primary selectee for battalion command	.0535
PLFS2	Predominant management style	.0721
ORGFS1	Primary selectee for battalion command	.0572
DIRFS1	Number of jobs performed as LTC	.0861

*Defined in Table 2, page 40.

Plan-Future produced significant results when compared to the education level of the respondents. Specifically, those respondents possessing a PhD thought this factor state less important than did the remainder of the respondents. The most likely explanation for this was that the smaller number of respondents with a PhD (three) did not allow compensation for a lower rating from one person. It was possible, however, that respondents with a PhD may be more flexible than others due to the nature of their academic training. This would cause them to place less emphasis on dealing with unknown situations since they must routinely do this in academic research.

Organize-Administration revealed significance with two background variables, the number of months the respondent had been in his present position and the largest number of personnel supervised. Those respondents with 19 to 24 months in their present job considered this factor state less important than did the other categories of respondents. The general trend was that the longer the time in the job, the less important these organizing activities became. This finding seemed logical in that the rules and administrative procedures of the organization would become more routine and require less emphasis as time progressed.

The relationship with the largest number of personnel supervised was not quite as distinct. Those respondents responsible for 50 or less personnel were significantly different from those responsible for 401 to 600. The trend

appeared to be that importance increased with the number of people supervised except for the largest group (601 or more). One possible reason for the decline in importance with the largest group is that most, if not all, of those in this category were battalion commanders, and the typical battalion has a standard operating procedure (SOP) which prescribes most of the routine rules and administrative procedures.

Organize-Subordinates had highly significant relationships with several background variables. Two of these variables were related to each other, and the results of each were mutually supportive. The respondents who had supervised 50 or fewer people were significantly different from those who had supervised 201 or more. The pattern was that the larger the number of people supervised, the more important were the activities in this factor state. Those respondents selected for battalion command (resulting in responsibility for a larger number of people) also felt that the two activities in this factor state were more important than did those not selected for battalion command. This clearly indicated that the larger the number of people supervised, the more important the development and dependability of subordinates became.

A relationship also existed between Organize-Subordinates and the number of jobs performed by the respondent. Those respondents holding either one or more than four jobs were significantly different from those

holding three jobs. The trend was that this factor state became more important as the number of jobs increased to three, and then declined in importance after the third job. One possible explanation for this was that those respondents holding more than three jobs may have been working in higher level staff positions where there are fewer subordinates, requiring less reliance on subordinates to accomplish their required duties.

The last background variable related to Organize-Subordinates was the number of months the respondent had been in his present position. Those respondents with 25 or more months in their present job were significantly different from those with 18 months or less. The activities in this factor state were more important to those with 18 months or less in their present position, and the tendency was for the activities to become less important the longer the job was held. This probably reflected a typical learning curve situation where the implementation of the pattern for subordinate development was primarily completed within the first 18 months, and then the emphasis shifted to maintaining the established pattern.

Only one background variable was found to be significantly related to Direct-Time. Those respondents with job specialties in the Combat Arms were significantly different from those with specialties in the Combat Support area. The Combat Arms officers considered the directing activities of

Direct-Time more important than either of the other two groups. This may have occurred because the nature of Combat Arms jobs frequently requires more active participation by the officer.

An identical pattern existed with the job specialties and Direct-Subordinates. Once again, the Combat Arms officers were significantly different from Combat Support officers, and those respondents in Combat Arms considered the activities in this factor state more important than did those respondents in either of the two other specialty areas. The fact that Combat Arms officers rated directing activities consistently higher was probably related to their increased direct participation as cited earlier.

Direct-Subordinates also had significant relationships with three other background variables. Respondents having performed only one job as a lieutenant colonel differed significantly from those having two, three or four jobs. The trend was that the activities in this factor state became progressively more important through the third job and then declined slightly thereafter. Since this factor state was primarily concerned with subordinate relationships, this pattern probably reflected the tendency of the respondents to move to higher level staff positions as they hold more jobs, requiring less interaction with subordinates.

The last two background variables reflecting significance were the largest number of people supervised and selection for battalion command. Once again these variables were related, and the results obtained demonstrated internal consistency. The respondents who had supervised 50 or fewer people were significantly different from all others. The trend was almost a direct relationship of increasing importance of the factor state with an increase in the number of people supervised.

Those respondents selected for battalion command also considered this factor state more important and were significantly different from those not selected for command. The two previous relationships indicated that the larger the number of people supervised, the more important were the interactions with subordinates of a directing nature.

The final two factor states dealt with controlling activities. Although no relationships of significance were found between the background variables and Control-Reporting, four significant relationships existed with Control-Operations.

Respondents possessing an MBA, in addition to a MA/MS degree, were significantly different from all other groups. This most likely resulted from the small number of respondents (three) in this category, although those with MA/MS and PhD degrees considered Control-Operations less important than did those with BA/BS or MBA degrees.

A much stronger relationship existed between Control-Operations and the number of months the respondent had been in his present position. Those with nineteen or more months in their present job were significantly different from those with six months or less. Those with less time perceived the activities in this factor state to be more important than those who had been in the job for a longer period of time. There was close to an inverse relationship between time in the job and the importance of this factor state, with the factor state activities becoming progressively less important as time in the job increased. If the activities in this factor state are, in fact, concerned with the day-to-day operation of the organization, this finding revealed some support for the theory of job "burn out." Another possible cause was that personnel new to the job placed more emphasis on the "output" of the organization, while those with more experience in their job focused on other areas.

The third relationship existed between Control-Operations and the largest number of people supervised. Those respondents who had supervised 50 people or less were significantly different from those who had supervised more than 50. The trend was for the activities in the factor state to increase in importance until the number of people supervised reached 400 and then to decline slightly in importance above that level. This most likely reflected the fact that those respondents who had supervised less than 50

people were predominantly in staff jobs where their tangible output was related to their own efforts rather than those of the organization as a whole.

The final relationship was between Control-Operations and those selected for battalion command. Those selected for command differed significantly from those not selected, perceiving the activities in this factor state to be more important. This probably resulted from what may be described as a friendly competitive relationship among battalion commanders seeking to exceed not only the minimum standards but also to exceed the results produced by their sister units.

CHAPTER V

FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter is organized into four sections, findings, conclusions, recommendations, and recommendations for future research. The first section answers the research questions posed in Chapter II, followed by the conclusions drawn from the research findings. The final two sections address both general recommendations derived from this research project and recommendations for further research.

The objectives of this research were (1) to identify those activities Army middle managers think are most important in performing their jobs; (2) determine if any of these activities are related to each other and can be combined into factor states; and (3) determine if there is a relationship between background variables and perceptions of factor state importance. To accomplish these objectives, the following questions were investigated and the findings are presented below.

A. Findings.

Research Questions Answered.

Question 1. What activities are perceived as most important by Army middle managers?

After selecting 24 management activities identified during the literature search as being important, a survey of

Army lieutenant colonels determined the order of relative importance of each activity. This survey identified the following as the six most important management activities.

1. Motivate subordinates to achieve organizational goals
2. Establish goals, objectives, and priorities for the organization
3. Delegate authority to subordinates
4. Develop subordinates for promotion to the next level
5. Forecast potential problems
6. Respond to new requirements and/or unforeseen circumstances.

Activities relating directly to organizational performance, though not found in the six most important activities, occupied the next three positions. These were:

7. Set performance standards
8. Conduct performance appraisals
9. Achieve performance standards.

Question 2. Are any of these activities related in a way which causes them to be answered similarly?
If so, can the relationship be determined?

A factor analysis conducted on the activities in each management function revealed mathematical relationships which allowed two or more activities to be grouped together. These related activities were then combined into factor states to facilitate further analysis.

The factor states, their components, and possible relationships are presented below.

Factor state PLFS1 (Plan-Early) - develop and integrate plans; forecast potential problems; and establish goals, objectives, and priorities for the organization. These activities appear to be related by the fact that they are normally accomplished during the early phases of the organizational activity cycle.

Factor state PLFS2 (Plan-Future) - create innovative ideas; respond to new requirements and/or unforeseen circumstances; and forecast future resource needs. These activities require more cognitive ability on the part of the manager and tend to deal more with future events.

Factor state ORGFS1 (Organize-Administration) - administer policy; attend/ complete courses to improve technical, human, or conceptual skills; set performance standards; and establish milestone schedules. These activities generally relate to the establishment of the rules and administrative procedures of the organization.

Factor state ORGFS2 (Organize-Subordinates) - delegate authority to subordinates; and develop subordinates for promotion to the next level. Both of these activities are concerned with increasing the ability and responsibility of subordinates.

Factor state DIRFS1 (Direct-Time) - minimize age of backorders/late documents; implement planned change and meet modification schedules; and manage the flow of information and communication. The common denominator among these activities appears to be related to effective time management.

Factor state DIRFS2 (Direct-Subordinates) - motivate subordinates to achieve organizational goals; minimize "not operationally ready" equipment; and improve the quality of the .pa workforce. The predominant relationship among these activities is the subordinate although this is not apparent for one of the activities.

Factor state CONFS1 (Control-Operations) - conduct performance appraisals; compare actual versus projected results; conduct periodic inspections of operations; and achieve performance standards. All of these activities constitute the majority of the requirements for management of day-to-day operations.

Factor state CONFS2 (Control-Reporting) - report to higher echelons; and collect and analyze data. The similarity between these two activities appears to be related to the reporting aspects of the controlling function.

Question 3: Are there background variables which are indicators of perceptions of factor state importance? If there appears to be a relationship, what is the cause?

Several relationships exist between background variables and the perceived importance of the factor states. Those with a job specialty in the Combat Arms perceive the directing activities as a group to be more important than those respondents with other specialties. The respondents who had only had one job as a lieutenant colonel considered the activities relating to subordinates to be less important than did those respondents holding more than one job.

The length of time the respondent had been in his job also served as a predictor of attitudes toward subordinates and the organizing function as a whole. The longer the respondent had been in his job, the less important were the activities relating to subordinates. The organizing activities relating to the administration of the organization also became less important as time in the job increased.

By far the most significant predictor among the background variables was the largest number of people supervised. Factor states from all management functions increased in importance as the number of people supervised increased.

Those respondents selected for battalion command attached more importance to the factor states relating to

development and use of subordinates. They also perceived the factor state relating to operations as being more important.

B. Conclusions.

Responses to the questionnaire indicated that the most important management activities were related first to subordinates and second to performance of the organization. This finding does not appear inconsistent with the values of a budget-based organization.

Perceptions of the importance of the various activities appear to be most dependent upon the number of people supervised and to a lesser degree, upon the length of time in the present job. The implication is that the emphasis placed on different activities must vary depending upon the size of the organization. A more disturbing implication is that the importance attached to subordinate development declines with the increased amount of time a job is held.

The last finding is that the method of selecting Army battalion commanders produces commanders equally concerned with the development of subordinates and mission accomplishment. These two tenets comprise the foundation of successful units in combat, the ultimate objective of the Army.

C. Recommendations.

One objective of this project was to determine the most important management activities as perceived by Army lieutenant colonels. Identifying the important activities

established a foundation for the development of output measures for the middle management subset of knowledge workers. The resulting output measures can then be used to develop productivity measurement techniques to assess manager performance. Based upon this research, the following recommendations are made.

1. The activities identified as being most important should be used as the groundwork for developing output measures for middle level managers of budget-based organizations.
2. The output measures used must be based upon both the characteristics of the organization and the job to which the manager is assigned. This would result in a unique measurement method for each manager as well as requiring it to be evolutionary in nature.
3. The productivity measures which are developed after defining the output should be kept simple and must be based on the goals of the organization.
4. Before productivity measurements are used to evaluate managers, a standard for comparison must be developed. Development should include the manager to be evaluated.
5. Given the importance of subordinates, as identified in the survey, productivity measures may be most effective when aggregated across more than one level of management, including subordinate managers' performance as well as the performance of the manager to be evaluated.

6. A quality dimension must be included in any productivity measurement. Results not meeting quality standards should not be considered output.

D. Recommendations for Future Research.

Future research efforts directed toward identifying important management activities may want to focus on the following areas:

1. If research is conducted using the same subset of middle level managers (LTC's), it is recommended that the sample be randomly drawn from all Army lieutenant colonels. Although requiring approval from Headquarters, Department of the Army, this would enable the research to select a sample of sufficient size to test the management activities individually rather than grouping them into factor states.
2. Research of this nature needs to be done in private industry. It is expected that there will be significant differences between budget-based organizations and those organizations which operate with a profit margin.
3. Given sufficient resources, it would be preferable to survey the sample using the Delphi technique. Early iterations may be used to identify those management activities which the managers, themselves, feel are important. Once a comprehensive list is obtained, the sample may then be surveyed to determine the relative importance of the activities identified.

CHAPTER VI

APPENDICES

APPENDIX A

LIST OF MANAGEMENT FUNCTIONS

DALE

Planning
Organizing
Staffing
Direction
Control
Innovation
Representation

GREENWOOD

Planning
Decision Making
Organizing
Staffing
Direction/Leadership

GROSS

Decision Making
Communication
Planning
Activating
Evaluating

JOHNSON/KAST/ROSENZWEIG

Planning
Organizing
Control
Communication

VOICH/WREN

Planning
Organizing
Controlling
Administering

KOONTZ/O'DONNELL

Planning
Organizing
Staffing
Directing
Controlling

LONGENECKER

Planning
Organizing
Directing/Motivating
Controlling

MASSIE

Decision Making
Organizing
Staffing
Planning
Controlling
Communicating
Directing

NEWMAN/SUMMER/WARREN

Organizing
Planning
Control
Administering

APPENDIX B

MANAGEMENT ACTIVITIES

The activities listed below for the four management functions were synthesized from the important activities identified by more than twenty different authors of management books and/or articles. The 29 activities contained in this appendix were derived from the more than 75 activities identified in the literature. Definitions used to classify the 75 management activities are also included. Six activities were chosen from each function to create a balanced design for the questionnaire. Those activities chosen for inclusion are designated with an asterisk.

PLAN To arrange the parts of (design); to devise or project the realization or achievement of (a program); to have in mind: intend.

Fayol's definition - Establishing forecasts and drawing up a plan of action.

- * Respond (orally or in writing) to new requirements and/or unforeseen circumstances.
- * Create innovative ideas.
- * Establish goals, objectives, and priorities for the organization.
- * Forecast future resource needs.
- * Develop and integrate short, intermediate, and long range plans dealing with cost, performance, and schedule.

ORGANIZE To arrange or form into a coherent unity; to set up an administrative structure for; to persuade to associate in an organization.

Fayol's definition - Addresses organizational structure, evaluation of managers, and managerial education.

- * Develop subordinate managers for promotion to the next level.
- * Delegate authority to subordinates.
- * Set performance standards.
- * Administer policy and establish/enforce standard operating procedures.
- * Attend/complete courses to improve technical, human, and conceptual skills.
- * Establish milestone schedules.
- Encourage questions for clarification.

DIRECT To regulate the activities or course of; to carry out the organizing, energizing, and supervising of; to train and lead performances of.

Fayol's definition - Setting the organization in motion.

- * Implement planned change and meet modification schedules.
- * Motivate subordinates to achieve organizational goals.
- * Minimize "not operationally ready" equipment
- * Improve the quality of the workforce.
- * Minimize age of backorders/late documents.
- * Manage the flow of information and communication.

CONTROL To check, test, or verify by evidence or experiment.

Fayol's definition - Verify whether things are occurring in accordance with the original plan.

- * Collect and analyze data.
- * Compare actual versus projected results
- * Report to higher echelons.
- * Achieve performance standards.
- * Conduct periodic inspections of operations.
- * Conduct oral and written performance appraisals.
- Diagnose and solve problems.
- Select quality control standards to be used.
- Explain problems and their causes.
- Respond to complaints and grievances.

APPENDIX C

BACKGROUND AND ORGANIZATIONAL VARIABLES

Recognition, compensation and incentive awards

- * Development programs/schools attended

Recruiting, selecting, and placement of managers

Current status of organizational evolution and environment

Number of organizations in the industry

Growth rate of the organization

Rate of technological change

- * Average size of the firm

Multinational make up of the organization

Traditions (and/or sense of conscience)

- * Style of management of the individual: (predominantly) participative - authoritarian

Authority commensurate with level of responsibility

Risk aversion

Trust in the organization

Similarity of the individual and organizational objectives

Working conditions

Willingness to allow mistakes

- * Job rotation expectations/job security

External environmental changes

- * Length of time in current position

Level of initiative

- * Race
- * Gender
 - Social Status
 - Job satisfaction
 - Confidence to act in accordance with personal convictions
- * Degree of functional specialization and amount of experience
 - Source of power (leadership, expertise, and persuasive power)
 - Physical/mental health
 - Career intentions (as currently planned)
 - Self concept
 - Time span for planning vs. action
 - Conformity vs. creativity
 - Degree of flexibility available (rules/laws)
 - Number of standard operating procedures
 - Proximity of those managed (remote locations)
 - Centralized vs. decentralized decision making
 - Span of control
 - Balance of influence among the subgroups of the organization
 - Clarity of management channels (chain of command)
 - Direct personal contact required
 - Past performance of the manager
 - Structure of the informal organization
 - Simple, accurate, verifiable standards required

Degree of standardization

-----MILITARY ONLY-----

- * Current grade and date of rank
- * "Below zone" promotions
- * Battalion command
- * Class standing at service schools
- * Combat experience

(* Identifies those items included in the survey)

APPENDIX D

MANAGEMENT ACTIVITY SURVEY



North Carolina State University
School of Engineering

Department of Industrial Engineering
Box 7906, Raleigh, N.C. 27695-7906

31 March 1985

SUBJECT: Management Activity Survey

1. The purpose of this questionnaire is to determine how important you think various management activities are in accomplishing the jobs you have performed as a lieutenant colonel. Your response will be compiled with others to attempt to draw conclusions as to the most important activities performed by managers. The results will also be statistically analyzed to learn if there is any correlation between background and perceptions of activity importance.
2. Most of the questions can be answered by circling a letter or number, and no narrative answers are required. Every effort has been made to limit the time needed to complete the survey to 15 minutes or less.
3. The number code on your questionnaire is used to distinguish geographic locations and for any follow-up information needed. Strict confidentiality will be maintained and no answers will be identified by individual. Survey results will be used by the undersigned as the basis of a research project required for a Master of Science degree in Industrial Engineering-Management Systems. If you desire a copy of the survey results an opportunity to so indicate is included in the survey.
4. Please return the survey in the enclosed envelope within one week from the date of receipt. If you anticipate any difficulties in responding that promptly, or have any questions, please contact CPT Robert (Bob) Almond at (919) 782-5495 (home phone). Thank you very much for your cooperation.

Robert L. Almond III
ROBERT L. ALMOND III
CPT, IN
Student Officer

MANAGEMENT ACTIVITY SURVEY

PLEASE INDICATE YOUR RESPONSE BY FILLING IN THE BLANK AND/OR
CIRCLING THE APPROPRIATE LETTER

1. Please list the numerical code for your Branch and all Functional Areas (non-accession/alternate specialties) in which you are qualified, together with the number of years experience in each.

BRANCH _____ (a) none (b) 4 or less (c) 5-9 (d) 10 or more
(11,12,etc.)
FUNCTIONAL _____ (a) none (b) 4 or less (c) 5-9 (d) 10 or more
AREA(S)
(51,54,etc.) _____ (a) none (b) 4 or less (c) 5-9 (d) 10 or more
2. What college degree(s) do you hold? (Circle all that apply)
(a) BA/BS (b) MS/MA (c) PhD (d) MBA (e) Other _____
3. Excluding assignments as a student, how many different jobs have you performed as a lieutenant colonel?
(a) 1 (b) 2 (c) 3 (d) 4 (e) more than 4
4. How many months have you been in your present position?
(a) 6 or less (b) 7-12 (c) 13-18 (d) 19-24 (e) 25 or more
5. What is the largest number of people you have had responsibility for in any one job as a lieutenant colonel?
(a) 50 or less (b) 51-200 (c) 201-400
(d) 401-600 (e) 601 or more
6. How many people are you responsible for now?
(a) 10 or less (b) 11-25 (c) 26-50 (d) 51-200 (e) 201 or more
7. How many people report to you directly?
(a) 1-3 (b) 4-6 (c) 7-9 (d) 10-12 (e) 13 or more
8. What is your date of rank as a lieutenant colonel?

9. Were you promoted to lieutenant colonel "below the zone"?
(a) No (b) Yes
10. Have you ever been a primary selectee for battalion level command?
(a) No (b) Yes
11. Have you ever been a "Distinguished" or "Honor" graduate of a service school?
(a) No (b) Yes
12. Have you ever served in a hostile fire zone?
(a) No (b) Yes
13. How would you describe your predominant management style?
(a) authoritarian (b) coordinative (c) participative

THE FOLLOWING ITEMS ARE REQUESTED FOR DEMOGRAPHIC PURPOSES ONLY

14. Race and National Origin
(a) American Indian or Alaskan native
(b) Asian or Pacific Islander
(c) Black, not of Hispanic origin
(d) Hispanic
(e) White, not of Hispanic origin
15. Sex
(a) Female (b) Male

PLEASE INDICATE BY CIRCLING THE APPROPRIATE NUMBER HOW IMPORTANT YOU THINK EACH ACTIVITY LISTED BELOW IS IN ACCOMPLISHING THE JOBS YOU HAVE HAD AS A LIEUTENANT COLONEL

	VERY IMPORTANT					NOT IMPORTANT	
	1	2	3	4	5	6	7
16. Develop and integrate plans (short, intermediate, and long range plans dealing with cost, performance and schedule)							
17. Motivate subordinates to achieve organizational goals (reconcile individual vs. organizational objectives)							
18. Forecast potential problems (problem prevention)							
19. Delegate authority to subordinates (allow subordinates latitude in decision making)							
20. Create innovative ideas (develop new products, techniques, etc.)							
21. Respond (orally or in writing) to new requirements and/or unforeseen circumstances (flexible to change/crisis management)							
22. Conduct performance appraisals (oral and/or written)							
23. Administer policy (enforce standard operating procedures/ regulations)							
24. Compare actual vs. projected results							
25. Minimize age of "backorders"/ late documents (prompt and accurate processing of paper-work)							
26. Implement planned change and meet modification schedules							
27. Conduct periodic inspections of operations (daily, weekly, or monthly inspections of safety, work methods, etc.)							

	VERY IMPORTANT					NOT IMPORTANT	
	1	2	3	4	5	6	7
28. Achieve performance standards (of quality, cost, schedule, and/or performance)	1	2	3	4	5	6	7
29. Establish goals, objectives, and priorities for the organization	1	2	3	4	5	6	7
30. Report to higher echelons (reports/briefings to higher echelons)	1	2	3	4	5	6	7
31. Attend/complete courses to improve technical (specialized knowledge), human (cooperation within the team), or conceptual (organization as a whole) skills	1	2	3	4	5	6	7
32. Develop subordinates for promotion to the next level (provide learning opportunities)	1	2	3	4	5	6	7
33. Minimize "not operationally ready" equipment	1	2	3	4	5	6	7
34. Forecast future resource needs (time, money, people)	1	2	3	4	5	6	7
35. Improve the quality of the work- force (provide education oppor- tunities, better methods, etc.)	1	2	3	4	5	6	7
36. Set performance standards (satisficing, optimizing, or somewhere between)	1	2	3	4	5	6	7
37. Establish milestone schedules	1	2	3	4	5	6	7
38. Manage the flow of information and communications (information received by those who need it)	1	2	3	4	5	6	7
39. Collect and analyze data	1	2	3	4	5	6	7

If you would like to be furnished a copy of the results of this survey, please indicate below your name and mailing address. Additional comments by separate attachment are welcome.

THANK YOU VERY MUCH FOR YOUR TIME AND COOPERATION

APPENDIX E

PART I

SURVEY CODE STRUCTURE AND FORMAT

Description and [Column]

Respondent Identification Number [1-3]

Branch Code 1 [5-6]

Branch Code 1 Experience [7]

- 1 - 0
- 2 - 4 or less
- 3 - 5-9
- 4 - 10 or more

Branch Code 2 [8-9]

Branch Code 2 Experience [10]

- 1 - 0
- 2 - 4 or less
- 3 - 5-9
- 4 - 10 or more

Branch Code 3 [11-12]

Branch Code 3 Experience [13]

- 1 - 0
- 2 - 4 or less
- 3 - 5-9
- 4 - 10 or more

College Degree Level [15]

- 1 - BA/BS
- 2 - MA/MS
- 3 - PhD
- 4 - MBA
- 5 - MS/MBA
- 6 - Other

Number of Jobs Performed [16]

- 1 - 1
- 2 - 2
- 3 - 3
- 4 - 4
- 5 - more than 4

Months in Present Assignment [17]

- 1 - 6 or less
- 2 - 7-12
- 3 - 13-18
- 4 - 19-24
- 5 - 25 or more

Largest Number of People Responsible for as 05 [18]

- 1 - 50 or less
- 2 - 51-200
- 3 - 201-400
- 4 - 401-600
- 5 - 601 or more

Number of People Presently Responsible for [19]

- 1 - 10 or less
- 2 - 11-25
- 3 - 26-50
- 4 - 51-200
- 5 - 201 or more

Span of Control [21]

- 1 - 0-3
- 2 - 4-6
- 3 - 7-9
- 4 - 10-12
- 5 - 13 or more

Months as an 05 [22-23]**Promoted Below the Zone [24]**

- 1 - No
- 2 - Yes

Primary Selectee for Battalion Command [25]

- 1 - No
- 2 - Yes

Service School "Distinguished" or "Honor" Graduate [26]

- 1 - No
- 2 - Yes

Combat Experience [28]

- 1 - No
- 2 - Yes

Predominant Management Style [29]

- 1 - Authoritarian
- 2 - Coordinative
- 3 - Participative

Race [30]

- 1 - American Indian or Alaskan native
- 2 - Asian or Pacific Islander
- 3 - Black, not of Hispanic origin
- 4 - Hispanic
- 5 - White, not of Hispanic origin

Sex [31]

- 1 - Female
- 2 - Male

		VERY IMPORTANT				NOT IMPORTANT		
		1	2	3	4	5	6	7
P16	Develop and integrate plans (short, intermediate, and long range plans dealing with cost, performance and schedule) [33]	1	2	3	4	5	6	7
D17	Motivate subordinates to achieve organizational goals (reconcile individual vs. organizational objectives) [34]	1	2	3	4	5	6	7
P18	Forecast potential problems (problem prevention) [35]	1	2	3	4	5	6	7
019	Delegate authority to subordinates (allow subordinates latitude in decision making) [36]	1	2	3	4	5	6	7
P20	Create innovative ideas (develop new products, techniques, etc.) [37]	1	2	3	4	5	6	7
P21	Respond (orally or in writing) to new requirements and/or unforeseen circumstances (flexible to change/crisis management) [39]	1	2	3	4	5	6	7
C22	Conduct performance appraisals (oral and/or written) [40]	1	2	3	4	5	6	7
023	Administer policy (enforce standard operating procedures/regulations) [41]	1	2	3	4	5	6	7
C24	Compare actual vs. projected results [42]	1	2	3	4	5	6	7
D25	Minimize age of "back-orders"/late documents (prompt and accurate processing of paperwork) [43]	1	2	3	4	5	6	7

D26	Implement planned change and meet modification schedules [45]	1	2	3	4	5	6	7
C27	Conduct periodic inspections of operations (daily, weekly, or monthly inspections of safety, work methods, etc.) [46]	1	2	3	4	5	6	7
C28	Achieve performance standards (of quality, cost, schedule, and/or performance) [47]	1	2	3	4	5	6	7
P29	Establish goals, objectives, and priorities for the organization [48]	1	2	3	4	5	6	7
C30	Report to higher echelons (reports/briefings to higher echelon) [49]	1	2	3	4	5	6	7
031	Attend/complete course to improve technical (specialized knowledge), human (cooperation within the team), or conceptual (organization as a whole) skills [51]	1	2	3	4	5	6	7
032	Develop subordinates for promotion to the next level (provide learning opportunities) [52]	1	2	3	4	5	6	7
D33	Minimize "not operationally ready" equipment [53]	1	2	3	4	5	6	7
P34	Forecast future resource needs (time, money, people) [54]	1	2	3	4	5	6	7
D35	Improve the quality of the workforce (provide education opportunities, better methods, etc.) [55]	1	2	3	4	5	6	7
036	Set performance standards (satisficing, optimizing, or somewhere between) [57]	1	2	3	4	5	6	7

037	Establish milestone schedules [58]	1	2	3	4	5	6	7
D38	Manage the flow of infor- mation and communications (information received by those who need it) [59]	1	2	3	4	5	6	7
C39	Collect and analyze data [60]	1	2	3	4	5	6	7

APPENDIX E
PART II
ENCODED DATA

APPENDIX F

ROTATED FACTOR PATTERNS FOR
MANAGEMENT ACTIVITIES

ORTHOGONAL TRANSFORMATION MATRIX

	1	2
1	0.76745	0.64111
2	-0.64111	0.76745

ROTATED FACTOR PATTERN

	FACTOR1	FACTOR2
P16	0.76489	0.01705
P18	0.57855	0.25177
P20	0.23737	0.62685
P21	-0.13014	0.90415
P29	0.75571	0.08557
P34	0.37908	0.51376

VARIANCE EXPLAINED BY EACH FACTOR

FACTOR1	FACTOR2
1.707854	1.545372

FINAL COMMUNALITY ESTIMATES: TOTAL = 3.253226

P16	P18	P20	P21	P29	P34
0.585343	0.398113	0.449285	0.834418	0.578418	0.407648

ORTHOGONAL TRANSFORMATION MATRIX

	1	2
1	0.77936	0.62658
2	-0.62658	0.77936

ROTATED FACTOR PATTERN

	FACTOR1	FACTOR2
019	-0.05569	0.86687
023	0.58833	0.28125
031	0.66406	0.00198
032	0.33413	0.75801
036	0.66049	0.47726
037	0.78185	0.03741

VARIANCE EXPLAINED BY EACH FACTOR

FACTOR1	FACTOR2
1.949383	1.634331

FINAL COMMUNALITY ESTIMATES: TOTAL = 3.583714

019	023	031	032	036	037
0.754567	0.425233	0.440977	0.686220	0.664032	0.612686

ORTHOGONAL TRANSFORMATION MATRIX

	1	2
1	0.71333	0.70083
2	-0.70083	0.71333

ROTATED FACTOR PATTERN

	FACTOR1	FACTOR2
D17	0.00077	0.73882
D25	0.73700	0.24329
D26	0.74080	0.45838
D33	0.15665	0.81761
D35	0.31307	0.62592
D38	0.83312	-0.07442

VARIANCE EXPLAINED BY EACH FACTOR

FACTOR1	FACTOR2
1.908591	1.880971

FINAL COMMUNALITY ESTIMATES: TOTAL = 3.789562

D17	D25	D26	D33	D35	D38
0.545863	0.602362	0.758899	0.693024	0.489793	0.699621

ORTHOGONAL TRANSFORMATION MATRIX

	1	2
1	0.85829	0.51317
2	-0.51317	0.85829

ROTATED FACTOR PATTERN

	FACTOR1	FACTOR2
C22	0.72604	-0.01914
C24	0.71180	0.35750
C27	0.75628	0.02170
C28	0.68661	0.17777
C30	0.24967	0.76275
C39	-0.03248	0.90452

VARIANCE EXPLAINED BY EACH FACTOR

FACTOR1	FACTOR2
2.140570	1.560182

FINAL COMMUNALITY ESTIMATES: TOTAL = 3.700751

C22	C24	C27	C28	C30	C39
0.527501	0.631461	0.572434	0.503028	0.644116	0.819210

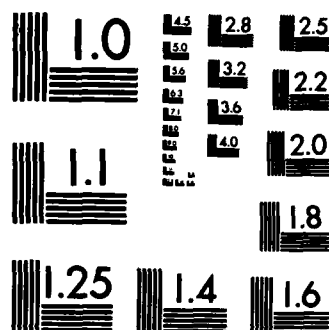
AD-A157 402 KNOWLEDGE WORKER PRODUCTIVITY MEASUREMENT: ESTABLISHING 2/2
A FOUNDATION FOR T. (U) ARMY MILITARY PERSONNEL CENTER
ALEXANDRIA VA R L ALMOND 07 AUG 85

UNCLASSIFIED

F/G 5/9

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

APPENDIX G
ANOVA RESULTS OF THE RELATIONSHIP BETWEEN
BACKGROUND VARIABLES AND FACTOR STATES

Variable	Factor State ¹	Pr >F
Job specialty (Combat Arms, Combat Support or Combat Service Support)	PFFS1	.5657
	PLFS2	.5176
	ORGFS1	.1952
	ORGFS2	.5429
	DIRFS1	.0395*
	DIRFS2	.0395*
	CONFS1	.1373
	CONFS2	.6568
Years of experience in the job specialty	PLFS1	.6402
	PLFS2	.3027
	ORGFS1	.2102
	ORGFS2	.9422
	DIRFS1	.2136
	DIRFS2	.1774
	CONFS1	.1867
	CONFS2	.1012
College degree level	PLFS1	.1522
	PLFS2	.0133*
	ORGFS1	.3837
	ORGFS2	.5263
	DIRFS1	.4420
	DIRFS2	.6662
	CONFS1	.0380*
	CONFS2	.2853
Number of jobs performed as a lieutenant colonel	PLFS1	.0981
	PLFS2	.2594
	ORGFS1	.3063
	ORGFS2	.0238*
	DIRFS1	.0861
	DIRFS2	.0221*
	CONFS1	.1308
	CONFS2	.6371
Months in present position	PLFS1	.7446
	PLFS2	.4077
	ORGFS1	.0455*
	ORGFS2	.0173*
	DIRFS1	.6240
	DIRFS2	.2587
	CONFS1	.0120*
	CONFS2	.5920

¹ See Chapter 4, Table 2, for definition of Factor States.

Largest number of people responsible
for as a lieutenant colonel

PLFS1 .0469*
PLFS2 .6323
ORGFS1 .0224*
ORGFS2 .0001*
DIRFS1 .1453
DIRFS2 .0001*
CONFS1 .0001*
CONFS2 .1033

Number of people responsible for now

PLFS1 .6237
PLFS2 .1631
ORGFS1 .4354
ORGFS2 .5526
DIRFS1 .1901
DIRFS2 .4749
CONFS1 .3913
CONFS2 .1669

Span of control

PLFS1 .4789
PLFS2 .7818
ORGFS1 .2455
ORGFS2 .6191
DIRFS1 .9837
DIRFS2 .1438
CONFS1 .2854
CONFS2 .6107

Promoted to lieutenant colonel "below
the zone"

PLFS1 .5441
PLFS2 .3461
ORGFS1 .4846
ORGFS2 .4266
DIRFS1 .3186
DIRFS2 .4213
CONFS1 .4542
CONFS2 .7881

Primary selectee for battalion command

PLFS1 .0535
PLFS2 .6151
ORGFS1 .0572
ORGFS2 .0001*
DIRFS1 .9858
DIRFS2 .0027*
CONFS1 .0129*
CONFS2 .1254

Service school distinguished or honor
graduate

PLFS1 .9158
PLFS2 .5799
ORGFS1 .1287
ORGFS2 .9581
DIRFS1 .9953
DIRFS2 .5340
CONFS1 .6804
CONFS2 .1713

Combat experience

PLFS1 .5463
PLFS2 .3348
ORGFS1 .6193
ORGFS2 .7135
DIRFS1 .2766
DIRFS2 .1998
CONFS1 .5860
CONFS2 .1137

Predominant management style

PLFS1 .2194
PLFS2 .0721
ORGFS1 .1513
ORGFS2 .7521
DIRFS1 .4186
DIRFS2 .1351
CONFS1 .2892
CONFS2 .5782

*Significant at .05 level.

APPENDIX H
DUNCAN'S MULTIPLE RANGE TEST
FOR SIGNIFICANT RELATIONSHIPS

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: DIRFS1
 NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
 NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=87 MSE=11.0133

WARNING: CELL SIZES ARE NOT EQUAL.
 HARMONIC MEAN OF CELL SIZES=24.8142

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN	GROUPING	MEAN	N	CAT
	A	9.9583	24	CS
B	A	9.2941	17	CSS
B				
B		7.9184	49	CA

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: DIRFS2
 NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
 NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=87 MSE=8.96809

WARNING: CELL SIZES ARE NOT EQUAL.
 HARMONIC MEAN OF CELL SIZES=24.8142

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN	GROUPING	MEAN	N	CAT
	A	8.0417	24	CS
B	A	7.0000	17	CSS
B				
B		6.1224	49	CA

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: PLFS2
 NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
 NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=88 MSE=5.18417

WARNING: CELL SIZES ARE NOT EQUAL.
 HARMONIC MEAN OF CELL SIZES=5.74686

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN	GROUPING	MEAN	N	CDL
	A	10.333	3	3
B				
B		7.333	3	5
B				
B		6.746	63	2
B				
B		5.750	8	4
B				
B		5.688	16	1

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: CONFS1
 NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
 NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=69 MSE=13.2468

WARNING: CELL SIZES ARE NOT EQUAL.
 HARMONIC MEAN OF CELL SIZES=5.74686

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN	GROUPING	MEAN	N	CDL
	A	15.667	3	5
	B	10.159	63	2
	B	10.000	3	3
	B	8.875	8	4
	B	8.563	16	1

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: ORGFS2
 NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
 NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=69 MSE=2.67266

WARNING: CELL SIZES ARE NOT EQUAL.
 HARMONIC MEAN OF CELL SIZES=15.4937

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN	GROUPING	MEAN	N	NJP
	A	4.5000	10	1
	A	4.1667	12	5
	A	3.5417	24	2
B	A	3.4000	15	4
B	A	2.7813	32	3

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: DIRFS2

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=89 MSE=8.63222

WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES=15.4837

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN	GROUPING	MEAN	N	NJP
	A	9.5000	10	1
	A			
B	A	7.5000	12	5
B				
B		6.4167	24	2
B				
B		6.3333	15	4
B				
B		6.0313	32	3

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: ORGFS1

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=88 MSE=10.5993

WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES=11.5835

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN	GROUPING	MEAN	N	MPP
	A	13.667	9	4
B		10.778	9	5
B				
B		10.593	54	2
B				
B		9.800	10	3
B				
B		9.364	11	1

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: ORQFS2
 NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
 NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=68 MSE=2.65041

WARNING: CELL SIZES ARE NOT EQUAL.
 HARMONIC MEAN OF CELL SIZES=11.5935

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN	GROUPING	MEAN	N	MPP
	A	5.0000	9	5
	A	4.0000	9	4
B		3.3333	54	2
B		2.8182	11	1
B		2.8000	10	3

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: CONF81
 NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
 NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=68 MSE=12.8528

WARNING: CELL SIZES ARE NOT EQUAL.
 HARMONIC MEAN OF CELL SIZES=11.5935

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN	GROUPING	MEAN	N	MPP
	A	12.444	9	4
	A	12.333	9	5
	A	9.700	10	3
B		9.667	54	2
B		7.545	11	1

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: PLFS1
 NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
 NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=88 MSE=4.28729

WARNING: CELL SIZES ARE NOT EQUAL.
 HARMONIC MEAN OF CELL SIZES=10.4876

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN	GROUPING	MEAN	N	LNPRF
	A	6.5926	27	1
	A			
B	A	5.6250	8	2
B	A			
B	A	5.3636	11	4
B	A			
B	A	5.1429	42	5
B	A			
B		4.4000	5	3

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: ORGFS1
 NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
 NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=88 MSE=10.3998

WARNING: CELL SIZES ARE NOT EQUAL.
 HARMONIC MEAN OF CELL SIZES=10.4876

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN	GROUPING	MEAN	N	LNPRF
	A	12.296	27	1
	A			
B	A	10.476	42	5
B	A			
B	A	9.400	5	3
B	A			
B	A	9.375	8	2
B	A			
B		9.000	11	4

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: ORGFS2
 NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
 NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=68 MSE=2.21864

WARNING: CELL SIZES ARE NOT EQUAL.
 HARMONIC MEAN OF CELL SIZES=10.4876

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN	GROUPING	MEAN	N	LNPRF
	A	4.7407	27	1
	A			
B	A	3.7500	8	2
B				
B		3.2000	5	3
B				
B		2.8182	11	4
B				
B		2.7381	42	5

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: DIRFS2
 NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
 NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=68 MSE=7.08259

WARNING: CELL SIZES ARE NOT EQUAL.
 HARMONIC MEAN OF CELL SIZES=10.4876

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN	GROUPING	MEAN	N	LNPRF
	A	9.2222	27	1
B		6.8000	5	3
B				
B		5.7500	8	2
B				
B		5.7273	11	4
B				
B		5.5952	42	5

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: CONF51

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=69 MSE=11.0217

WARNING: CELL SIZES ARE NOT EQUAL.

HARMONIC MEAN OF CELL SIZES=10.4976

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN	GROUPING	MEAN	N	LNPRF
	A	12.852	27	1
	B	9.750	8	2
	B	8.786	42	5
	B	8.455	11	4
	B	7.600	5	3

ANALYSIS OF VARIANCE PROCEDURE

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SCHEFFE'S TEST FOR VARIABLE: ORGFS2

NOTE: THIS TEST CONTROLS THE TYPE I EXPERIMENTWISE ERROR RATE
BUT GENERALLY HAS A HIGHER TYPE II ERROR RATE THAN REGWF
FOR ALL PAIRWISE COMPARISONS.

ALPHA=0.05 DF=91 MSE=2.48587
CRITICAL VALUE OF T=1.98638
MINIMUM SIGNIFICANT DIFFERENCE=0.660646

WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES=44.9462

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

SCHEFFE	GROUPING	MEAN	N	PSBC
	A	4.2368	38	1
	B	2.8909	55	2

ANALYSIS OF VARIANCE PROCEDURE

SCHEFFE'S TEST FOR VARIABLE: DIRFS2

NOTE: THIS TEST CONTROLS THE TYPE I EXPERIMENTWISE ERROR RATE
BUT GENERALLY HAS A HIGHER TYPE II ERROR RATE THAN REGWF
FOR ALL PAIRWISE COMPARISONS.

ALPHA=0.05 DF=91 MSE=8.59637
CRITICAL VALUE OF T=1.98638
MINIMUM SIGNIFICANT DIFFERENCE=1.22853

WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES=44.9462

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

SCHEFFE	GROUPING	MEAN	N	PSBC
	A	7.8684	38	1
	B	5.9636	55	2

ANALYSIS OF VARIANCE PROCEDURE

SCHEFFE'S TEST FOR VARIABLE: CONFS1

NOTE: THIS TEST CONTROLS THE TYPE I EXPERIMENTWISE ERROR RATE
BUT GENERALLY HAS A HIGHER TYPE II ERROR RATE THAN REGWF
FOR ALL PAIRWISE COMPARISONS.

ALPHA=0.05 DF=91 MSE=13.4112
CRITICAL VALUE OF T=1.98638
MINIMUM SIGNIFICANT DIFFERENCE=1.53449

WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES=44.9462

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

SCHEFFE	GROUPING	MEAN	N	PSBC
	A	11.105	38	1
	B	9.145	55	2

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